Operation and Maintenance

HANDBOOK

RAPCO 144 IRIG TIMECODE READER

Configuration: IRIG Standard Timecodes.

This handbook also covers optional features as listed.

Search Control
RS232 Interface.
Twin Input

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SPECIFICATION

Timecode Reader - Model 144

POWER SUPPLY — 240V/120V rms (switchable), Single Phase.a.c.

Permissible voltage range 220V to 260V (110 to 130V)
Permissible frequency range 45Hz to 440Hz.

Note: For supply frequency range 45 to 66Hz, permissible voltage range is 210V to 260V (105V to 130V)

Power loading 15VA max, 10VA typical

a.c. fuse rating — 240V setting 0.1A anti surge
120V setting 0.2A anti surge

CONNECTORS

Power	J1	3 pin IEC mains connector to CEE22 and BS4491 Mating socket with 2 metre cable supplied.
Serial I/F	J2	9-way 'D' type socket.
Timecode Inputs	J5,J6	BNC - Mating part MIL UG 88/E/U or equivalent. Note: On standard units J5 & J6 are wired in parallel as a convenience feature for system cabling. When the twin input option is fitted J5 is Input A and J6 is Input B.

SIZE

Width	207mm
Height	44mm
Depth	250mm including front panel projections excluding rear panel connectors.

FIXING POINTS — Standard rack fixing holes in front panel.
Two threaded (OBA) mounting holes on each side.
Note: Maxm. screw penetration 6mm.

FINISH — Matt black anodising on all surfaces
Engraved legends and lettering.

CONTROLS — POWER ON (Rocker Switch), DISPLAY BRIGHT (Button)
ARM, SELECT, ROLL (Buttons, option)
TIMECODE SOURCE (Switch, option)

INDICATORS — Solid State discrete

POWER (a.c.), SIGNAL LOW, SEARCH, AHEAD,
ON TIME, BEHIND.

Subsidiary Indicators
ALARM, REM, FWD, REV, ERROR.

DIGITAL DISPLAY

Red 0.3" 7-segment LED. 9 digits.

Display Intensity

Front panel control button giving five distinct brightness levels.

TIMECODE INPUT

Format

IRIG A version: day,hr,min,sec,tenth sec in 1/10 sec frame.
Carrier frequency 10KHz
IRIG B version: day,hr,min,sec in 1 sec frame.
Carrier frequency 1kHz.

Input Impedance

100k ohm nominal

Input Signal

Amplitude

1V rms (2.8V p-p) nominal
0.3V rms (0.8V p-p) minimum on marks
3.5V rms (10V p-p) maximum on marks
Safe amplitude without damage,30V p-p.

Code Direction

Forward or Reverse (auto sensing)

Mod. Index

2.5:1 minimum
5:1 maximum

Speed Range

16:1 IRIG A, 128:1 IRIG B, speed up

1:256 IRIG A,1:64 IRIG B,slow down

Note:

(i) Mod.Index range is specified over full amplitude range and either code direction with speed 1:1.

(ii) Speed range is specified at 1V rms on marks, with Mod.Index 4:1 and in either code direction.

(iii) Bandwidth limitation on IRIG 106 record channels may prohibit use of the full speed range on some instrumentation recorders, particularly when reproducing timecode signals.

SIGNAL LOW

Indicator

Red LED on front panel

Threshold

Indicator lights when input signal has fallen below 0.2V rms (0.6V p-p) on marks

Response Time

3 seconds nominal.

TEMPERATURE RANGE

Operating

0°C to + 40°C RH 90%

Storage

-40°C to +70°C RH 30%

BRIEF OPERATING INSTRUCTIONS

NOTE: For a more comprehensive description of controls see subsequent pages.

To switch on Power

Set POWER switch to ON (down) position (Red rocker switch at right of front panel).

a.c. POWER 'on' is indicated by the amber led adjacent to the power switch.

See specification pages for supply voltage range figures.

To switch off unit

Set POWER rocker switch to the 'up' position which will extinguish the a.c. power led and switch off the unit.

General

Normal operation will commence as soon as a valid timecode signal is applied at the rear panel connector. If the unit is fitted with the twin input option, ensure that the correct input signal, A or B as required, is selected on the front panel TIMECODE SOURCE switch.

The SIG LOW indicator should be 'off' and the ERROR indicator dot should also be 'off', if the incoming code is valid.
The display brightness may be varied in five distinct steps by the blue DISPLAY BRIGHT button.

The direction in which code is being read will be indicated by the REV/FWD indicator dots in the display window.

Search Mode setting procedure (option)

First ensure that the unit is not already in the search active state. The green led above the SEARCH button should be 'off'; if it is 'on', press SEARCH button once to return unit to normal state. To set a search target time first press ARM button and hold in for >3 seconds, until the red 'arm' led illuminates. Press ROLL to adjust the reading of the seconds digits to the required time. Press SELECT to choose another digit pair for adjustment then ROLL to acquire desired setting. Repeat as required to set hours digits, or make further changes to seconds or minutes as required.
When required target time is displayed, press ARM again to return to normal state. Press SEARCH to set unit to search active state.

See FRONT PANEL CONTROLS for more detailed description of button functions.

FRONT PANEL CONTROLS

The front panel controls comprise:

1. POWER Switch and indicator.
2. DISPLAY BRIGHT button
3. ARM button (option)
4. SELECT button (option)
5. ROLL button (option)
6. SEARCH button (option)
7. TIMECODE SOURCE Switch (option)

POWER switch and Indicator

The POWER switch is located at the right-hand side of the front panel. The switch is a rocker action toggle type. The ON/OFF state of the power switch is indicated by the POWER ON indicator (amber) which is located above the switch. Lamp illuminated means a.c. power supply is ON.

DISPLAY BRIGHT button

This button is active at all times (except when the unit is in the ARM mode.)* Pressing the button will set the display to the next brightness level from the sequence (20%, 40%, 60%, 80%, full; 80%, 60%, 40%, 20% etc.) *If the button is held down for 2 seconds,* the display will set directly to maximum brightness, from any previous state.

If the button is held down continuously for more than 4 seconds, the 'display test' mode is set and remains set until the button is released.

In 'display test' mode all of the display segments will be illuminated (including decimal points) along with the SIG LOW and other discrete leds. Releasing the button returns the display to its normal operating state at the 60% brightness setting. The timecode reader functions are not affected by operating the 'display test'.

This button does not affect the 'power' led which is operated directly from the units regulated supply rail.

* ARM Mode only applies to units fitted with the SEARCH Control option.

ARM button (Search control option only)

This button is located to the left of the panel; it is used to set the unit into the ARM mode, allowing the adjacent SELECT and ROLL buttons to be used for setting a SEARCH target time.

When the ARM button is pressed and held pressed for a period of approximately 3 seconds, the red ARM led will illuminate, indicating that the ARM mode is now active.

When the button is released, the decimal point 'dot' indicators on the seconds display digit pair will illuminate indicating that the seconds digits are 'selected' for adjustment.

The time shown on the display, which is the required SEARCH target time, can now be adjusted using the SELECT and ROLL buttons.

Note: Selection of the ARM state as described above does not interfere with the process of reading the timecode, or operation of the serial interface if fitted. It does however, discontinue the timecode display procedure so that the display can show the search target time setting.

To exit from the ARM state, press ARM button again; this will extinguish the ARM led and return the unit to the normal state, with the display showing the state of the incoming timecode.

The search target time setting will be that shown at the time when the ARM mode is discontinued. It can be reexamined by re-entry into the ARM mode as described above.

Entry to, or exit from the ARM state does not start or stop a SEARCH condition. (See description below of SEARCH button usage). Similarly, attempts to enter the ARM state when the unit is already in the SEARCH mode (green indicator on) will fail. (Red ARM light will not come on).

SELECT button (Search control option only)

This button is only active when the ARM led is on. i.e. when the ARM mode is active. Pressing the SELECT button will move the decimal point dots on the display to the left (eg. seconds to minutes) to enable the next digit pair to be set. Use this button to select any digit pair for setting as required. When in use (red ARM led 'on') the decimal point dots in the display act only as an indicator to the selected digit pair and the legends below the display eg. 'error' 'rev' etc. should be ignored. They only apply when the unit is in the normal mode.

ROLL button (Search control option only)

This button is only active when the ARM led is on, ie. when the ARM mode is active. Pressing it will cause the digit pair previously selected by the SELECT button to increment. The digits may be 'stepped' by use of brief depressions of ROLL, or if the ROLL button is held down for 1 second or more, the digit pair may be incremented continuously in a 'fast roll' mode, through its natural range, 000 to 999 for days (ident) digits, 00 to 23 for hours, 00 to 59 for minutes and 00 to 59 for seconds, with the addition (in the seconds case only) of additional states 'A' for both units of seconds and tens of seconds.

The use of the 'A' setting indicates 'All' and allows the search resolution (normally one second) to be widened to either:

10 seconds if the units of seconds digit is set to 'A'

or 1 minute if both the tens and units of seconds are set to 'A'.

These low resolution modes can be useful when working with poor quality tape recordings or under similar conditions where a one frame 'on-time' zone is too short.

SEARCH button (Search control option only)

This button is active when the unit is in the NORMAL mode, ie, when the ARM led is off. Pressing the button under these conditions will result in the SEARCH mode becoming active, indicated by the green search mode led above this button.

Pressing SEARCH again will cause exit from the search mode and the green indicator will go off.

The SEARCH mode may not be entered when the unit is is the ARM state, but in this state the SEARCH button is given an auxiliary function, allowing the audible alarm buzzer to be activated or deactivated. These alternate states are indicated by the alarm indicator dot at the left hand end of the display window, which may be alternately set on or off. When the alarm indicator is on, the audible alarm buzzer will sound for a period of 1/2 sec. when the on-time state is detected, ie. when the incoming timecode frame matches the search target setting. The audible alarm will not sound when the ALARM indicator is off.

The operation of the ON TIME indicator led and the electrical output at the rear panel CONTROL connector are not affected by the setting of the audible ALARM indicator.

TIMECODE SOURCE (Twin input option only)

This two position rocker switch allows user selection of either of the TIMECODE INPUT sockets J5, SOURCE A or J6, SOURCE B, as the signal source for the reader. It may be used to select either one of two timecode sources in installations where it is convenient to do so, without having to change cable connections at the rear of the unit.

POWER-ON CONDITION

The power-on condition is as follows:

Display	.....	60% brightness
Time-code input	.....	Active
Time-code display	.....	000 00 00 00 if no input signal present, or reading time if valid input signal present.
Arm Mode	.....	Off
*Search Mode	.....	Off
*Audible 'on time' alarm	.....	Active, with ALARM indicator lit in display window.
*Control Output Signals	.....	Off

* Applies only on units fitted with search control option.

The Search Control (option)

This optional feature is available to order on 14x units and is fitted at time of original manufacture.

The facilities provided include front panel setting buttons to allow a search target time to be set by the user and a search mode select button and indicator to allow the search action to be made active or inactive.

The setting buttons are protected by a separate arm button which avoids accidental changes being made to the target time.

When the search mode is active, the current incoming timecode reading is continually compared with the preset target time; and front panel indicators show behind - when the timecode is less that the target

on time - when the timecode matches the target

ahead - when the timecode is greater than the target.

These indications are available as electrical output signals on a rear panel mounted socket. (See below).

The on-time condition may be indicated by an audible alarm buzzer which may by muted by the operator.

The resolution of the on time indication may be widened by the operator from the normal one frame (one second at real time speed) to ten frames, or sixty frames.

For details regarding use of the control buttons to set up a search target time and set the unit to the search mode, see section on 'Front Panel Controls'.

The rear panel CONTROL connector is a 5-way x 180° DIN standard socket having the following connections.

PIN 1	STOP	(ON TIME)
2	0V	
3	SPARE	
4	AHEAD	
5	BEHIND	

The output signals are from open collector n.p.n transistors having an applied voltage rating when in the 'off' state of 0 to +30 volts and an absolute maximum sink current rating when saturated of 100mA. No internal protection devices are fitted and it is the users responsibility to see that the above ratings are not exceeded. In particular, external inductive loads must be fitted with clamp diodes.

The output signals are normally 'off' (high is externally pulled up) and go 'on' at occurence of an event.

The 'on' saturation voltage of the output transistors is typically 1 volt at a sink current of 100 mA.

The STOP (ON TIME) output is a pulse indication (duration 100msecs approx.) and the AHEAD and BEHIND outputs are continuous signals for the duration of the condition.

All outputs are 'off' when the unit is not in the search active mode.

THE SERIAL PORT RS232 (option)

When fitted, the Serial interface is a 9-way 'D' type socket (DE9S), J2 Pin designations are shown below.

Output signal levels and input signal specifications are in accordance with EIA-RS232C.

Pin No.	Function
1	Chassis (Protective Ground)
2	SDI - Serial Data - INPUT
3	SDO - Serial Data - OUTPUT
4	DTR - Data Teminal Ready - OUTPUT
5	Signal Ground
7	RTS - Ready to Send - OUTPUT
8	CTS - Clear to Send - INPUT

Serial Communication parameters are not user adjustable; they are set by the readers internal software as follows:

Character format	8 bits
Baud Rate	4800
Stop Bit Length	1 bit
Parity	None

THE CONTROL COMMAND SET

Command Format

The command format used on the serial control port is of the form

[ASCII letter character/s] [byte string (parameter)] [delimiter]

Note: (a) Command identity letter/s may be in upper case or lower case.

(b) The parameter string is required only on 'special application' commands and is not applicabale on standard units.

(c) The standard delimiter character is Carriage Return (ASCII 0DH).

(d) Line Feed (ASCII 0AH) characters are ignored, so controllers sending CR LF will operate without error.

(e) Spaces and punctuation characters are illegal.

Command Set

The following standard commands are recognised by the serial interface.

Format	Command Name
RT<CR>	Read Time
RS<CR>	Read Status
W<CR>	Wrap (test)

The following search related commands are recognised by the serial interface on units fitted with the optional search function.

SAdddhhmmss<CR>	Set search target time
RA<CR>	Read search target time
SMx<CR>	Set alarm, off/on
SLx<CR>	Set panel, lock/unlock
SS<CR>	Start search function
SH<CR>	Stop search function

THE CONTROL COMMAND SET(cont'd)

Command definitions - Standard commands.

RT<CR>

This command transfers the current time (on acceptance of <CR>) to the output buffer for transmission. The response from the time-code reader is Tdddhhmmss<CR><LF>

RS <CR>

This command causes the reader to transmit the data contained in its status byte/s, as an ASCII letter/number string representing their hexadecimal value.

See Drg. No. 2321-3634

Note that the status bits in a standard reader are arranged in a single byte, whereas in a reader with the search option they occupy two bytes.

Response string is Syz<CR><LF> for the standard reader

or Swxyz<CR><LF> for a search option unit.

Wabcdef.....<CR>

This command allows any string of characters (up to 14 in length), followed by Carriage Return, to be sent to the unit whereupon they will be transmitted (without the command letter W) as a test of normal operation of the interface. Note that the test string should not include LF or CR characters, or the response string will not be identical to the transmitted string, which is the object of such a test.

Z<CR>

This command initiates a software reset, causing the unit to adopt the initial (power-up) reset state with all preset data (time etc.) lost.

Command-Definitions - Search related commands.

Applicable only on units fitted with the optional search function.

SAdddhhmmss<CR>

This command allows the search target time to be remotely set via the control interface, where ddd = day of year 001 to 365 (366 leap)
hh = hours 00 to 23
mm = minutes 00 to 59
and ss = seconds 00 to 59

RA<CR>

This command allows the current search target time to be read via the control interface. Response is Adddhhmmss<CR><LF> where dddhhmmss is the current search target time as ddd = day of year
hh = hours
mm = minutes
and ss = seconds

SMx<CR>

This command allows the search function alarm buzzer to be enabled or disabled. x may be 0 or 1 where SM0<CR> = search buzzer enable
SM1<CR> = search buzzer disable.

SLx<CR>

This command allows the front panel search setting buttons ARM, ROLL, SELECT, SEARCH, to be enabled or disabled. x may be 0 or 1

where SL0<CR> = Set panel to unlocked state
SL1<CR> = Set panel to locked state

Note: The DISPLAY BRIGHT button is not affected by the panel lock function.

SS<CR>

This command starts the search function which will continue in effect until a SH (Halt) command is received. In the search state the front panel 'ahead', 'on-time', 'behind' indicators, and the control output logic, are active. The search alarm buzzer may also be active unless it has been disabled via a SM1 command.

SH<CR>

This command halts (cancels) the search state and will disable the front panel search indicators, control output logic and search alarm buzzer. Halting and/or restarting the current search state does not affect the current search target time setting, which will remain as last set until overwritten by another SA command, or changed by manual setting, or cleared (to 001:00:00:00) by a Z (software reset) command or power-up cycle.

THE UNIT STATUS BYTE

Bit allocations for the internal status bytes are shown in Drg.No. 2321-3634.

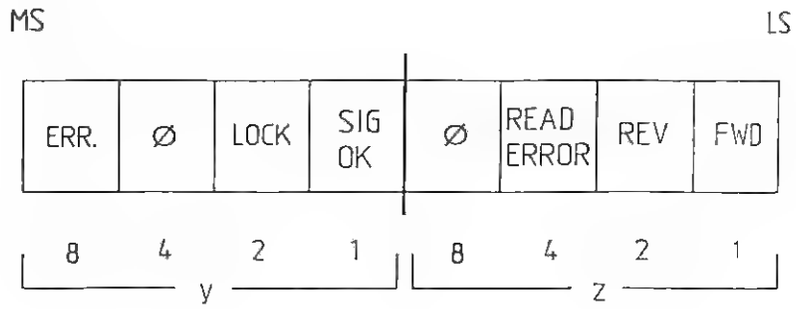
For standard units the bit descriptions are:-

ERR	In error state (serial comms. error)
NU	Not used (zero)
LOCK	In remote state (panel locked)
SIG OK	Input signal is above minm. level
NU	Not used (zero)
READ ERROR	Last frame faulty (timecode error)
REV	Reading reverse code) both low if
FWD	Reading forward code) no frames read.

For units with the search option bit descritions are:-

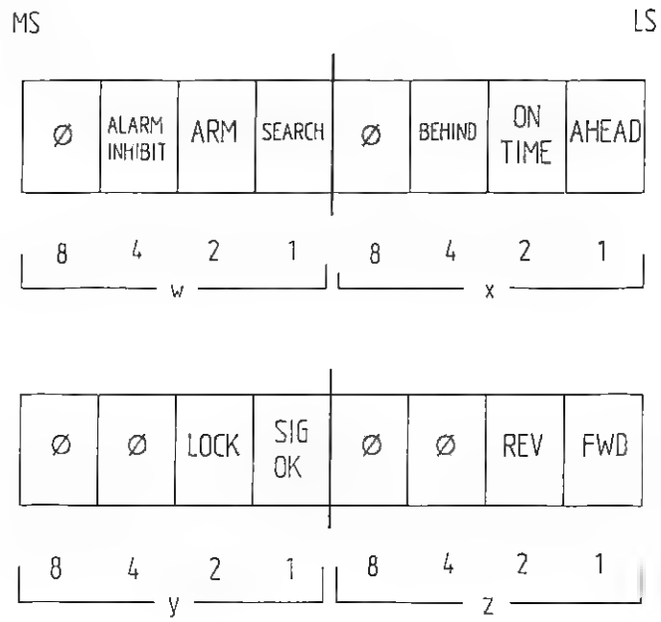
NU	Not used (zero)
ALARM INHIBIT	Search alarm (buzzer) is inhibited
ARM	In ARM (manual setting) state
SEARCH	In search (active) state
NU	Not used (zero)
BEHIND	Reader time is less than search target
ON TIME	Reader time equals search target
AHEAD	Reader time is greater than search target
NU	Not used (zero)
NU	Not used (zero)
LOCK	In remote state (panel locked)
SIG OK	Input signal is above minm. level
NU	Not used (zero)
NU	Not used (zero)
REV	Reading reverse code) both low if
FWD	Reading forward code) no frames read.

STANDARD UNITS



RESPONSE TO AN RS COMMAND
IS Syz

UNITS WITH SEARCH OPTION



RESPONSE TO AN RS COMMAND
IS Swxyz

DRAWN : DB DATE : 24/5/90
CHKD :PLB DATE : 24/5/90

STATUS BIT ALLOCATIONS
14X SERIES READERS

DRG.No. 2321-3634
ISSUE A

THE ERROR STATE

(a) Standard Units

The software may detect an error condition due to a variety of causes which are summarised below. This error state will result in the command or action causing the error being ignored, and the setting of an error bit in the status byte. The status byte may be read by sending a valid read-status (RS) command which will result in the transmission of the status data in ASCII-Hex coding.

A read-status command, if valid, will always reset the error bit to zero. It is essential for the system software to decode the status characters in the response to ensure that each command has been correctly actioned by the unit.

Possible causes of error state are:

(i) Format failure, eg. too many characters

(ii) Illegal command, eg. invalid command letter like 'B' C_R

(iii) Unit busy (transmitting previous reading)

(b) Units fitted with search option

The error state is handled differently on search equipped units, in that the status byte no longer contains an error bit. Instead, an error state causes the standard response string or command reflection to be replaced by an error response string of the form ERn<CR><LF> where n represents the error category as:-

Error Response	Fault
ER1	Format failure/Illegal command/Busy - as above or Parameter out of range.
ER2	Unit in ARM (manual set) mode - from an SS command
ER3	Unit in search mode - from an SA command.

Rapco Electronics **ITEMS LIST** 29 Jul 1992

Sub Assembly No 144 ASSY ISS 3 IRIG READER

Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
A 0	SWITCH CK 7201 J51 ZQ32	1	MAINS ON/OFF	N		RED ROCKER BLACK BEZEL
A 1	INSULATING BOOT 544-106	1		N		RS
A 5	SWITCH CK 8121 J81 1 2	1	SW6 SEARCH	Y	ENGRAVED TO DRG 2234-3003	BLACK BEZEL WHITE LENS
A 10	SWITCH CK 8121 J81 4 2	1	SW1 ARM	Y	ENGRAVED TO DRG 2234-3003	BLACK BEZEL ORANGE LENS
A 15	SWITCH CK 8121 J81 5 2	1	SW3 ROLL	Y	ENGRAVED TO DRG 2234-3003	BLACK BEZEL YELLOW LENS
A 20	SWITCH CK 8121 J81 6 2	1	SW2 SELECT	Y	ENGRAVED TO DRG 2234-3003	BLACK BEZEL GREEN LENS
A 25	SWITCH CK 8121 J81 7 2	1	SW4 BRIGHTNESS	N	ENGRAVED TO DRG 2234-3003	BLACK BEZEL BLUE LENS
A 30	LED RS 585-539	1		Y	SEARCH	GREEN
A 35	LED RS 585-545	1		N	POWER	AMBER
A 40	PLUG MAINS WITH FILTER	1	MAINS I/P	N		ROXBURGH RX733MC
A 45	INSULATING BOOT L1867A/L	1		N		
A 50	SOCKET RS 488-208	1		N		
A 55	CLAMP FOR IEC CONN.	1		N		RS 488-810
A 60	SOCKET BNC INSULATED	2		N		RS 456-706
A 65	FUSEHOLDER F296/S	1		N		
A 70	INSULATING BOOT BUL/9820	1		N		FOR FUSEHOLDER F296/S
A 75	FUSE 200MA A/S	1		Y	FOR 120V SUPPLY	20mm x 5mm Anti-surge
A 80	FUSE 100MA A/S	1		Y	FOR 240V SUPPLY	20mm x 5mm Anti-surge
A 85	SWITCH T2225B	1	VOLTAGE SELECT	N		ARCOLECT.(F'NELL 147-911
A 86	2321-4006	1		N		INS. BOOT FOR T2225B
A 110	FILTER POLARISED 343/4	1		N	TO DRG. 2234-3006	
A 140	SOCKET 5 WAY DIN 478-633	1		Y	REQ'D FOR INTEGRAL SEARCH	180c PROFESSIONAL
A 142	PLUG 5 WAY DIN LATCHING	1		Y	REQ'D FOR INTEGRAL SEARCH	5 WAY 180 RS 478-172
A 145	BUZZER SMB-06	1		Y	REQ'D FOR INTEGRAL SEARCH	
A 160	BLANKING PLATES (VARIOUS)	0		N	TO DRG 759-1280 (AS REQ'D)	**** NON STOCK ITEM ****
M 0	2321-3165	1		Y		FRONT PANEL WITH SEARCH
M 1	2321-3180	1		Y		FRONT PANEL (NO SEARCH)
M 5	2321-3258	1		N		REAR PANEL
M 10	1250	1		N		SIDEBAR
M 15	1251	1		N		SIDEBAR
M 20	1252	1		N		BOTTOM COVER
M 25	1253	1		N		TOP COVER
M 35	1670-2197/1	2		N		SPACER
M 40	1670-2197/2	2		N		SPACER
S 0	2321-3162	1		N	MOTHERBOARD ASSY	**** NON STOCK ITEM ****
S 5	2321-3008/IRIG	1		N	DISPLAY BOARD ASSY	**** NON STOCK ITEM ****
S 10	2321-3211 MK3	1		N	IRIG INPUT & DECODER ASSY	**** NON STOCK ITEM ****
S 15	2102-3345	1	CABLE ASSY I76	N		**** NON STOCK ITEM ****
S 20	2321-3086	1	CABLE ASSY I62B	N		**** NON STOCK ITEM ****
S 25	2321-3169	1	CABLE ASSY I60	Y	REQ'D IF SERIAL I/FACE FITTED	**** NON STOCK ITEM ****
S 30	2321-3170	1	CABLE ASSY I61	Y	REQ'D FOR INTEGRAL SEARCH	**** NON STOCK ITEM ****
S 35	2791-3972	1	CABLE ASSY I173	Y	REQ'D FOR INTEGRAL SEARCH	**** NON STOCK ITEM ****
S 40	2102-2825	1	CABLE ASSY I4	Y	REQ'D FOR SEARCH I/FACE-2088	**** NON STOCK ITEM ****
X 0	SCREW 4BA X 5/8 BRASS	1	EARTHING POINT	N	POZIDRIV PAN HEAD	**** NON STOCK ITEM ****
X 5	4BA FULL NUT BRASS	2	" "	N		**** NON STOCK ITEM ****
X 10	4BA CRINKLE WASHER	1	" "	N		**** NON STOCK ITEM ****
X 15	4BA EARTH TAG	1	" "	N		**** NON STOCK ITEM ****
X 20	SCREW M2 X 16 CSK SLOTTED	4		N	BLACK	**** NON STOCK ITEM ****
X 21	CRINKLE WASHER M2	4		N		**** NON STOCK ITEM ****
X 22	FULL NUT M2	4		N		**** NON STOCK ITEM ****
X 23	SCREW 6BA X 3/8 CSK SLOT	12		N	BLACK	**** NON STOCK ITEM ****
X 24	SCREW 6BA X 1/2 CSK POZI	14		N	BLACK	**** NON STOCK ITEM ****
X 26	SCREW M3 X 8 PAN HEAD POZ	4		N		**** NON STOCK ITEM ****
X 27	BLANKING BUTTON	3		N	TO SUIT 9MM DIA HOLE	**** NON STOCK ITEM ****
X 28	6BA FULL NUT	6		N		**** NON STOCK ITEM ****

Rapco Electronics **ITEMS LIST** 29 Jul 1992

Sub Assembly No 144 ASSY ISS 3 IRIG READER

Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
X 29	6BA CRINKLE WASHER	6		N		**** NON STOCK ITEM ****
X 30	6BA SOLDER TAG	6		N		**** NON STOCK ITEM ****
X 31	8BA X 1/2" SCREW	2		N		**** NON STOCK ITEM ****
X 32	8BA FULL NUT	2		N		**** NON STOCK ITEM ****

Rapco Electronics **ITEMS LIST** 7 Apr 1992

Sub Assembly No 2321-3162 ISS 7 MOTHERBOARD ASSY

Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
A 0	PCB 3162	1		N		2321-3162-E
A 5	PCB STAND OFF SCB-M3-20MM	4		N	FIT BEFORE OTHER COMPONENTS	
B 0	IC 74HC00	1	N8	N		
B 5	IC 74HC14	1	N9	N		
B 10	IC 74HC32	2	N6.N7	N		
B 15	IC 74HC74	3	N1.N10.N30	N		
B 20	IC 74HC138	1	N13	N		
B 25	IC 74HC139	1	N14	N		
B 30	IC 74HC244	1	N23	N		
B 35	IC 74HC245	1	N22	N		
B 40	IC 74HC390	1	N29	N		
B 45	IC 74HC540	2	N4.N21	N		
B 50	IC CMOS 4040	1	N28	N		
B 55	IC CMOS 74C922	1	N2	N		
B 60	IC ICL8211CPA	1	N31	N		
B 65	IC ICM7218CIJI	2	N17.N18	N		
B 70	IC PROM 27C64-20	1	N25	N		8K X 8 ERASABLE E-PROM
B 75	IC RAM HM62o4P-15	1	N26	N		8K X 8 CMOS STATIC RAM
B 80	IC DS14C88N	1	N12	N		
B 85	IC DS14C89AN	1	N11	N		
B 90	IC IDT7201S4-120P	1	N5	N		
B 91	IC IDT7201S4-120P	1	N20	Y	REQ'D FOR 2086 I/FACE	
B 95	IC 82C55	1	N19	N		
B 100	IC 82C59	1	N3	N		
B 105	IC HD6418ORIP6	1	N24	N		
B 110	IC SN75477P	2	N15.N16	N		
B 115	NOT FITTED	0	N27	N		**** NON STOCK ITEM ****
C 0	VOLTAGE REG LCP6	1	REG 1	Y		SEE
C 5	VOLTAGE REG LM317T	1	REG 2	Y		
C 10	VOLTAGE REG LM2940CT-5	1	REG 3	N		
C 15	DIODE 1N4001	4	D5.D6.D6.D7	N		
C 20	DIODE 1N4148	1	D4	N		
C 23	DIODE 11DB03	2	D9.D10	N		
C 25	DIODE 31DQ04	1	D2	N		IR
C 30	BR RECT KBL02	1	BR1	Y	Not required for DC version	
C 35	ZENER DIODE BZX85C4V7	1	D1	N		4.7v
C 45	ZENER DIODE 1N5366B	1	D8	N		39v 5w 5% TOL.
C 50	TRANSISTOR 2N7000	2	TR1. TR2	N		
C 55	CRYSTAL 12.288MHZ	1	X1	N		HC49/U HOLDER
D 0	CAP 22PF CERAMIC	2	C4.C5	N		RS 188-838
D 5	CAP 330PF FKC2	1	C16	N		
D 10	CAP 470PF FKC2	1	C3	N		
D 15	CAP 2200PF FKS2	1	C17	N		
D 20	CAP 3300PF FKS2	1	C15	N		
D 25	CAP .01MFD 500V PTR	1	C22	N		RS 112-765
D 30	CAP .1MFD PTR 5MM	6	C2.C10.C19.C23.C24.C25	N	(C20 NOT FITTED)	IRD 607/100nK
D 33	CAP .1MFD CERAMIC 5MM	2	C26.C27	N		8123205001042Z or equiv
D 35	CAP 1MFD 35V BEAD TANT	1	C1	N		
D 40	CAP 2.2MFD 16V BEAD TANT	3	C12.C14.C18	N		
D 45	CAP 4.7MFD 16V BEAD TANT	1	C21	N		
D 50	CAP 10MFD 25V AXIAL	2	C6.C7	N		030-36109
D 55	CAP 22MFD 25V AXIAL	1	C8	N		030-36229
D 60	CAP 33MFD 16V AXIAL	1	C11	N		MULLARD 030-35339
D 65	CAP 220MFD 16V 031-35221	1	C9	N		PHILLIPS AXIAL
D 70	CAP 2200MFD 63V SU	1	C13	N		PANASONIC ECEB1JU222

Rapco Electronics **ITEMS LIST** 7 Apr 1992

Sub Assembly No 2321-3162 ISS 7 MOTHERBOARD ASSY

Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
E 0	RESNET 8S0-91-10K	2	RN1.RN2	N		SIL 9 PIN 8 RES
E 3	RES 1R5 W21	1	R33	N		
E 5	RES 150R 1% MF	1	R14	N		
E 10	RES 390R 1% MF	1	R15	N		
E 11	RES 1K TR5	1	R32	N		
E 15	RES 1K 1% MF	2	R16.R27	N		
E 16	RES 1K5 TR5	1	R13	N		
E 20	RES 1K8 1% MF	1	R19	N		
E 25	RES 2K7 1% MF	1	R22	N		
E 30	RES 4K7 1% MF	4	R21.R28.R30.R31	N		
E 35	RES 5K1 1% MF	1	R23	N		
E 40	RES 9K1 1% MF	1	R26	N		
E 45	RES 10K 1% MF	9	R3-R8, R10-R12	N		
E 50	RES 15K 1% MF	1	R17	N		
E 55	RES 18K 1% MF	1	R29	N		
E 60	RES 22K 1% MF	2	R1.R2	N		
E 62	RES 47K 1% MF	1	R9	N		
E 65	RES 68K 1% MF	2	R24.R25	N		
E 70	RES 470K 1% MF	1	R20	N		
E 75	NOT FITTED	0	R18	N		**** NON STOCK ITEM ****
F 0	DIL SKT 8 WAY	3	N15.N16.N31	N		
F 5	DIL SKT 14 WAY	1	N12	N		
F 6	DECOUPLED IC SKT 14 WAY	8	N1, N6-N11.N30	N		
F 10	DECOUPLED IC SKT 16 WAY	4	N13.N14.N28.N29	N		
F 15	DIL SKT 18 WAY	1	N2	N		
F 20	DECOUPLED IC SKT 20 WAY	4	N4.N21-N23	N		
F 23	DIL SKT 24 WAY TURNED PIN	1	CN1	N		LOW PROFILE
F 24	DECOUPLED IC SKT 28 WAY	6	N3.N5.N20.N25-N27	N		
F 25	DIL SKT 28 WAY TURNED PIN	2	N17.N18	N		LOW PROFILE
F 30	DIL SKT 40 WAY	1	N19	N		
F 35	DIL SKT 64 WAY SHRINK DIP	1	N24	N		0.07 PITCH TURNED PIN
G 0	TRANSFORMER 40/2762	1	TF1	Y	Not required for DC version	AVEL LINDBERG TOROID
G 5	MAINS WARNING LABEL	1	TF1	Y	Not required for DC version	**** NON STOCK ITEM ****
G 10	CHOKE RS 238-255	1	L2	N		
G 15	INDUCTOR 220UH	1	L1	N		DELEVAN 3443-56
G 20	DC-DC CONV PDA 03 A35	1	CN1	N	FITTED IN DIL SKT	5v 1/P DUAL 12V O/P
G 25	FUSECLIP RS 412-784	2	FS1	Y	Not required for DC version	
G 30	FUSE 1A	1	FS1	Y	Not required for DC version	20mm x 5mm
G 35	FUSE COVER 340e20	1	FS1	Y	Not required for DC version	
H 0	BATT CONN D2 P/S	2	CON 1. CON 2	N		
H 5	SCOTCHFLEX 3431-6302	2	PL1.2	N		24 WAY HEADER STRAIGHT
H 10	SCOTCHFLEX 3593-6002	1	PL3	N		26W HEADER LOW PROFILE
H 15	SCOTCHFLEX 3426-6302	1	PL4	N		2v WAY HEADER STRAIGHT
H 20	M50 PIN HEADER 5 WAY STR	1	PL5	N		VEROSPEED 901-71312K
H 25	M50 PIN HEADER 10 WAY	1	PL6	N		VEROSPEED 901-713136
H 27	BERG HEADER 4 WAY IN LINE	1	PL7	N		DUBOX 76384-304
H 28	BERG HEADER 6 WAY STR	3	PL8. PL9. PL10	N		BERG DUBOX 76385-303
H 30	JUMPER SKT 2 WAY	4		N		HARWIN M7566-06
H 35	PIN HEADER 3 WAY STR	4	LK1-LK4	N		CUT FROM BERGSTIK 75160
H 40	PIN HEADER 2 WAY STR	1	LK5	N		CUT FROM BERGSTIK 75160
H 45	TERMINAL PIN 050/LTB/2	1	TP8	N		
H 50	SOCKET 30S/093/VL RED	1	ASR	N		
H 55	SOCKET 30S/093/VL BLACK	1	ASB	N		
H 60	SOCKET 30S/093/VL PINK	1	DCLK O/P PULSE	Y	154G ONLY (CONN TO N29 PIN 1)	
H 65	HARWIN PIN H2121	3	TX SEC.CONNS. B & Y. + CHASSIS	N		**** NON STOCK ITEM ***

Rapco Electronics **ITEMS LIST** 7 Apr 1992

Sub Assembly No 2321-3162 ISS 7 MOTHERBOARD ASSY

Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
H 70	CABLE TIE TYB523M	2	CN1	N	FITTED AFTER TEST	

Rapco Electronics

ITEMS LIST

3 Nov 1989

Sub Assembly No 2321-3008/IRIG DISPLAY BOARD ASSY

Ref		Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
A	0	PCB 3008	1		N		2234-3008
B	0	LED DISPLAY HDSP7301	9	DIG1 - DIG9	N		
B	5	LED HLMP1301	1	LED5 (SIGNAL LOW)	N		RED
B	10	LED HLMP1301	1	LED1 (ARM)	Y	REQ'D IF SEARCH OPTION FITTED	RED
B	15	LED HLMP1401	3	LED2,3,4 (< = >)	Y	REQ'D IF SEARCH OPTION FITTED	YELLOW
C	0	SCOTCHFLEX 3934-0000T	1	CON5)	N		34 WAY 2 ROW PCB CONN
C	5	SCOTCHFLEX 3414-6000	1	CON5) CABLE ASSY 142	N		34 WAY SOCKET
C	10	SCOTCHFLEX 3448-3034-	1	CON5)	N		STRAIN REL.FOR 3414-60[illegible]
C	15	SCOTCHFLEX CABLE 34 WAY	0		N	APPROX. 3" REQD.	COLOUR CODED 3302/34
[illegible]	0	PIN VERO 18-0223K	14	L6A,L6k,S1,S2,S3,S4,S5,S6 A&B	N		**** NON STOCK ITEM ****

Rapco Electronics **ITEMS LIST** 29 Jul 1992

Sub Assembly No 2321-3211 MK3 ISS 3 IRIG INPUT & DECODER

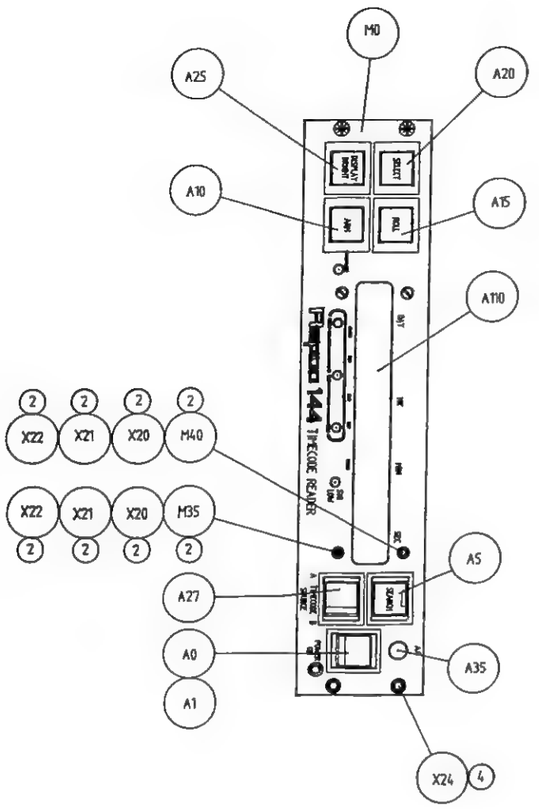
Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
0	REFER TO CCT 2710-3703	0				
A 0	PCB 3211	1		N		2321-3211-D
B 0	IC 74HC00	1	N13	N		
B 5	IC 74HC04	1	N10	N		
B 10	IC 74HC10	1	N14	N		
B 15	IC 74HC14	1	N1	N		
B 20	IC 74HC32	1	N4	N		
B 25	IC 74HC74	5	N2,3,7,8,9	N		
B 30	IC 74HC299	1	N11	N		
B 35	IC 74HC540	1	N12	N		
B 40	IC 74HC4017	1	N15	N		
B 45	IC 74HC4520	2	N5,6	N		
B 50	IC LF355	1	N19	N		
B 55	IC LF357	2	N18,22	N		
B 60	IC LM311N	4	N16,17,20,21	N		
C 0	TRANSISTOR J 108	2	VT1,3	N		
C 5	TRANSISTOR BC212L	1	VT2	N		
C 10	DIODE 1N4148	3	D1 - 3	N		
D 0	CAP 33PF PLATE CERAMIC	3	C14,20,21	N		MULLARD 683-34339 (5MM)
D 5	CAP 100PF DISC CERAMIC	1	C13	N		RAU06UJ101JL45AE
D 10	CAP 1000PF CERAMIC 2.5MM	2	C26,C31	N		RS 125-749
D 15	CAP .01MFD CERAMIC DISC	13	4,7,10-12,17,18,22,23,27-29,32	N		MURATA DD350BC103M50
D 20	CAP .1MFD PTR 5MM	3	C2,3,24	N		IRD 607/100nK
D 25	CAP .47MFD 63V B32529	1	C19	N		SIEMENS POLYESTER 5MM
D 30	CAP 1MFD 35V BEAD TANT	1	C25	N		
D 35	CAP 10MFD 16V BEAD TANT	4	C1,15,33,34	N		
D 40	CAP 22MFD 25V BEAD TANT	1	C16	N		
D 45	CAP 47MFD 16V RADIAL	4	C5,6,8,9	N		ECC TYPE SRA1B SUB-MIN
D 46	CAP 470MFD 16V AXIAL	1	C35	N		
D 47	CAP SOT	1	C30	N		**** NON STOCK ITEM ****
E 0	RES 150R 1% MF	2	R1,2	N		
E 5	RES 330R 1% MF	2	R18,30	N		
E 10	RES 681R 1% MF	1	R7	N		
E 15	RES 1K 1% MF	5	R5,24-26,32	N		
E 20	RES 5K6 1% MF	2	R12,20	N		
E 25	RES 10K 1% MF	2	R3,29	N		
E 30	RES 13K7 1% MF	1	R4	N		
E 35	RES 1K5 1% MF	2	R13,17	N		
E 40	RES 18K 1% MF	1	R27	N		
E 45	RES 22K 1% MF	3	R21-23	N		
E 50	RES 47K 1% MF	3	R16,33,34	N		
E 55	RES 56K 1% MF	2	R19,31	N		
E 60	RES 68K 1% MF	1	R10	N		
E 65	RES 100K 1% MF	3	R8,9,11	N		
E 70	RES 221K 1% MF	1	R15	N		
E 75	RES 470K 1% MF	1	R6	N		
E 80	RES 2M2 CF	2	R14,28	N		
E 85	RES SOT	2	R35,36	N		**** NON STOCK ITEM ****
E 95	POT 1K 3266W-1-102	1	VR1	N		
F 0	DIL SKT 8 WAY	7	N16-22	N		
F 5	DECOUPLED IC SKT 14 WAY	10	N1-4,7-10,13,14	N		
F 10	DECOUPLED IC SKT 16 WAY	3	N5,6,15	N		
F 15	DECOUPLED IC SKT 20 WAY	2	N11,12	N		
F 20	SCOTCHFLEX 3920-0000T	1	PL1)	N		20 WAY 2 ROW PCB CONN.
F 25	SCOTCHFLEX 3421-6000	1	)INTERNAL CABLE ASSY I40	N		20 WAY SOCKET

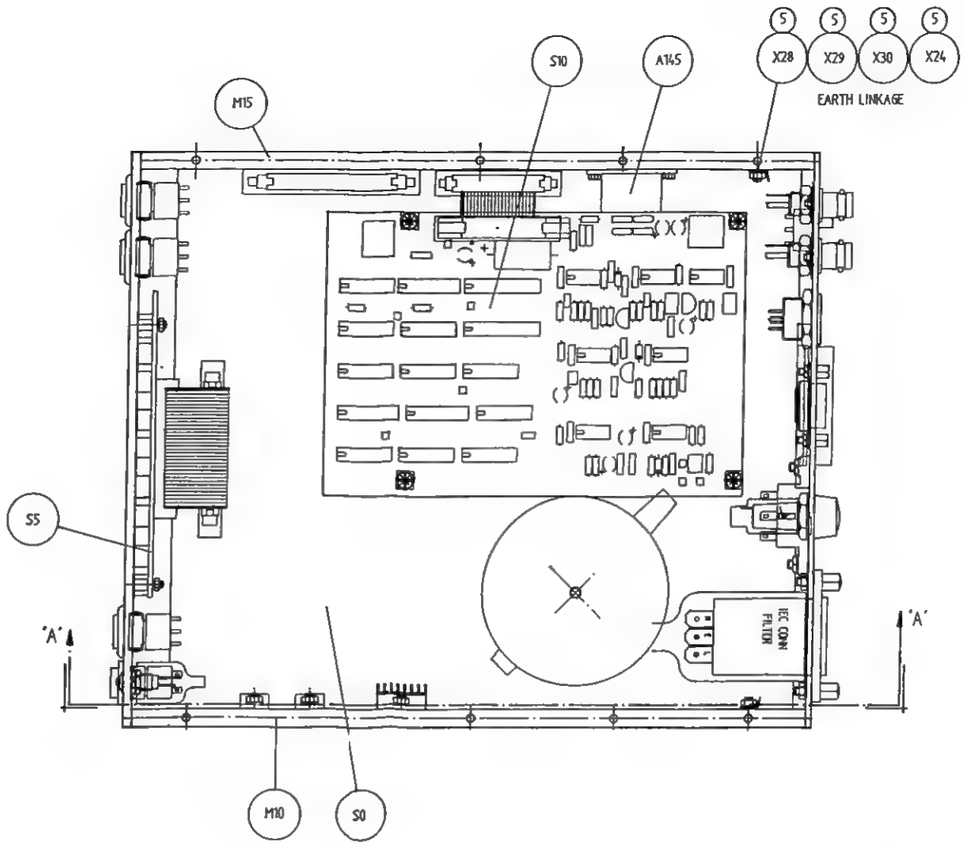
Rapco Electronics **ITEMS LIST** 29 Jul 1992

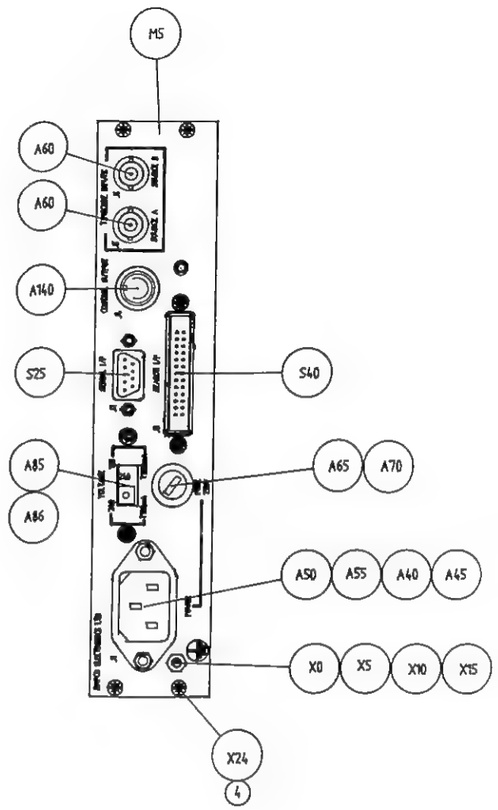
Sub Assembly No 2321-3211 MK3 ISS 3 IRIG INPUT & DECODER

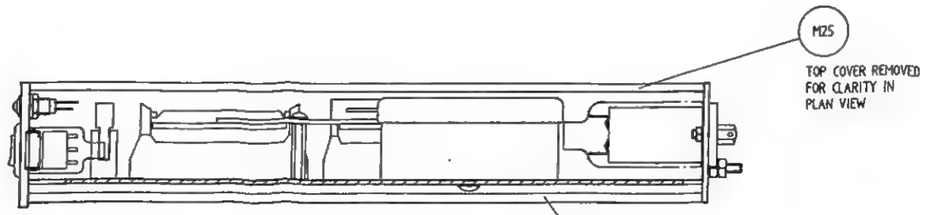
Ref	Item Code	Quantity	Circuit Reference	Option	Remarks & Option Details	Item Code Comment
F 30	SCOTCHFLEX 3448-3020	1	)	N		STRAIN REL.FOR 3421-6000
F 35	BERG HEADER 10 WAY RA	2	PL2,PL6	N		BERG DUBOX 76383-305
F 40	PIN HEADER 2 WAY STR	2	LK2,LK3	N		CUT FROM BERGSTIK 75160
F 45	PIN HEADER 3 WAY STR	1	LK1	N		CUT FROM BERGSTIK 75160
F 50	JUMPER SKT 2 WAY	1	LK1	N		HARWIN M7566-06
6 0	TERMINAL PIN 050/LTB/2	8	TPA,TPB,0V,TP1,TP2,TP3,TP4 +	N	+ TPA0V	

DRG.No. 2821 – 3908	THIRD ANGLE PROJECTION METRIC mm.	REMOVE ALL BURRS AND SHARP CORNERS	DO NOT SCALE









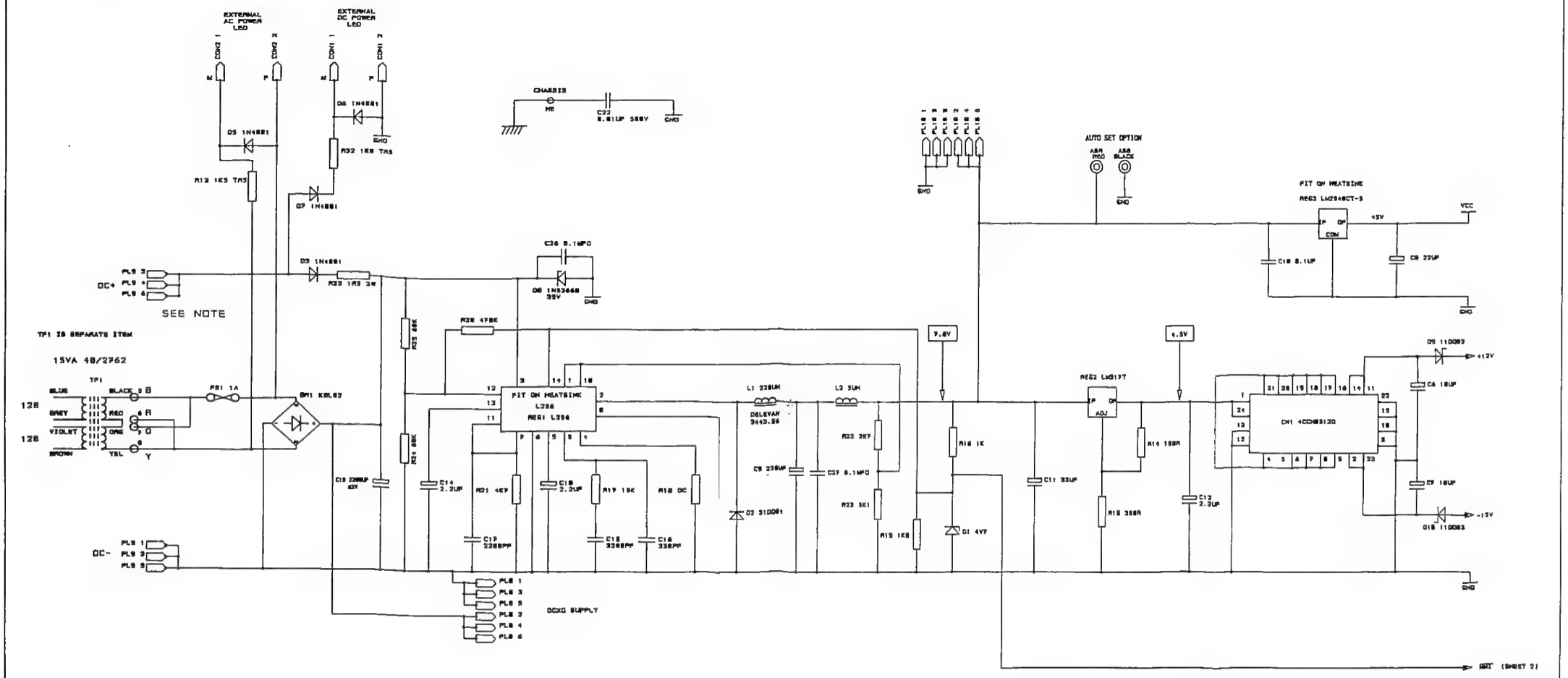
SECTION ON 'A – A'

CHECKED	DATE
R.B	26/4/91

A1

MATERIAL :								RAPCO ELECTRONICS LTD			
FINISH								TITLE GENERAL ASSEMBLY (MECH) 144 READER WITH SEARCH AND OPTION 5			
NOTES :	ISSUE	CHANGES	DATE	ISSUE	CHANGES	DATE	DRAWN D.BAKER	DATE 26/4/91	SCALE 1:1	
	THIRD ANGLE PROJECTION			METRIC mm. DESIGN Tol. +/- 0.2mm UNLESS STATED OTHERWISE			DRG.No. 2821 – 3908		ISSUE A	

W/O NO.	2321	DWG NO.	3162
USED ON	777.1xx SERIES AFTER SEPTEMBER 91		



NOTE

CIRCUIT DIAGRAM SHOWN APPLIES TO ISSUE D PCB, OR HIGHER
SEE DRG. No. 2791-3981 FOR POWER INPUT WIRING

FOR USE WITH ISSUE E PCBS ONWARDS

ISSUE	DATE	MOD NO.
E	28 05 91	564
F	25 09 91	588
G	10 10 91	601
H	17 10 91	603

W/O NO.	2321	
FIRST ISSUE	DATE	
DRAWN KS	24 08 88	
CHECKED PLB	07 08 90	

RAPCO ELECTRONICS LTD.

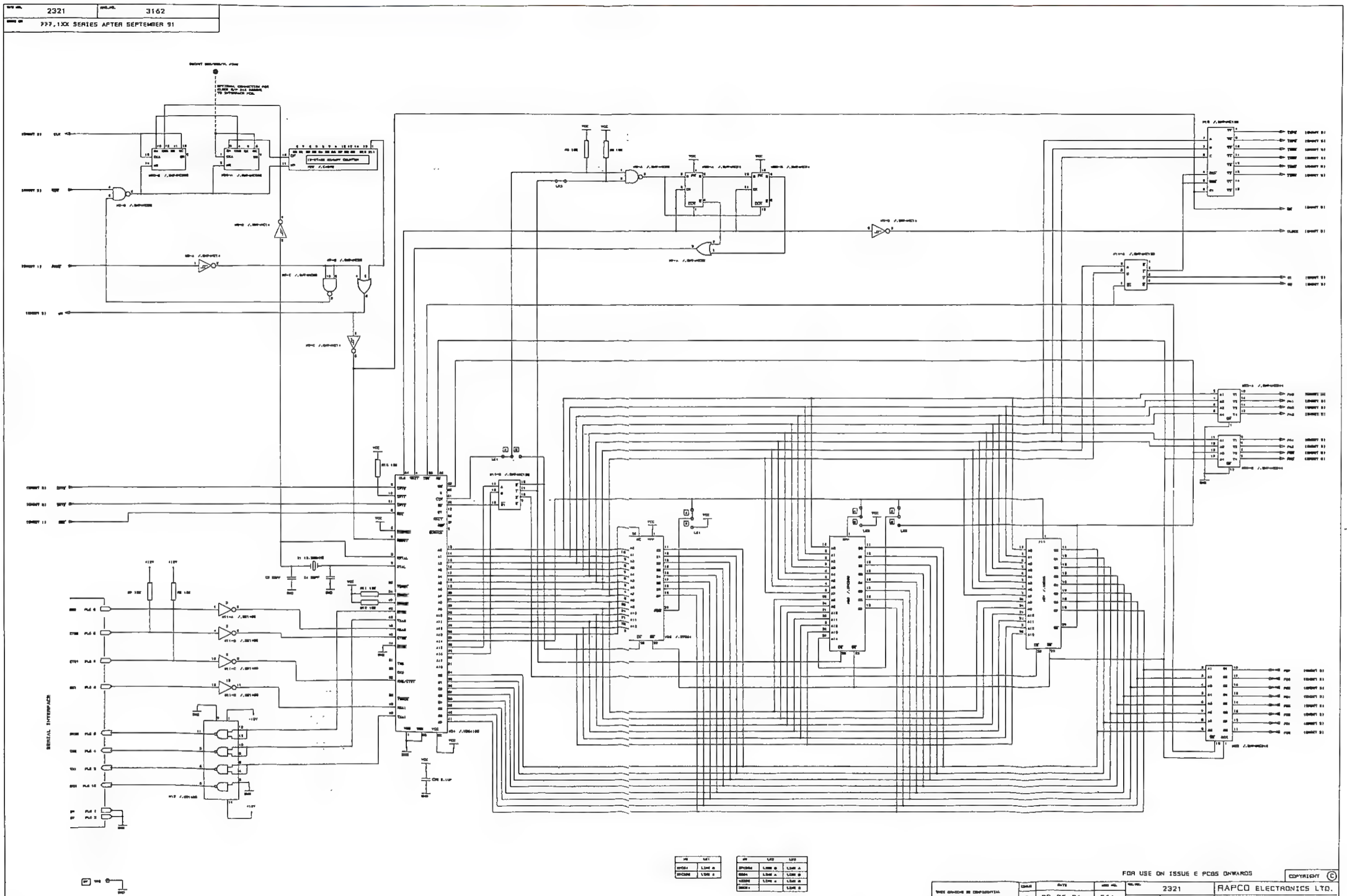
TITLE 1XX.7?? SERIES MOTHERBOARD POWER SUPPLY

ORIG. SIZE	DWG NO.
A2	3162
SCALE N.T.S	SHEET 1 OF 3

RAPCO CAD

STD.CENTRE 32148X 28265Y

2321	3162
???,1XX SERIES AFTER SEPTEMBER 91	



FOR USE ON ISSUE E PCBS ONWARDS

ISSUE	DATE	DRG NO.
E	29 05 91	564
F	25 09 91	588
G	18 10 91	681
H	17 10 91	683

SYS NO.	2321
PCB/ISSUE	DATE
DRAWN	KS 31 08 88
CHECKED	PLB 07 08 90
ORIG. SIZE	A1
SCALE	N.T.S

RAPCO ELECTRONICS LTD.

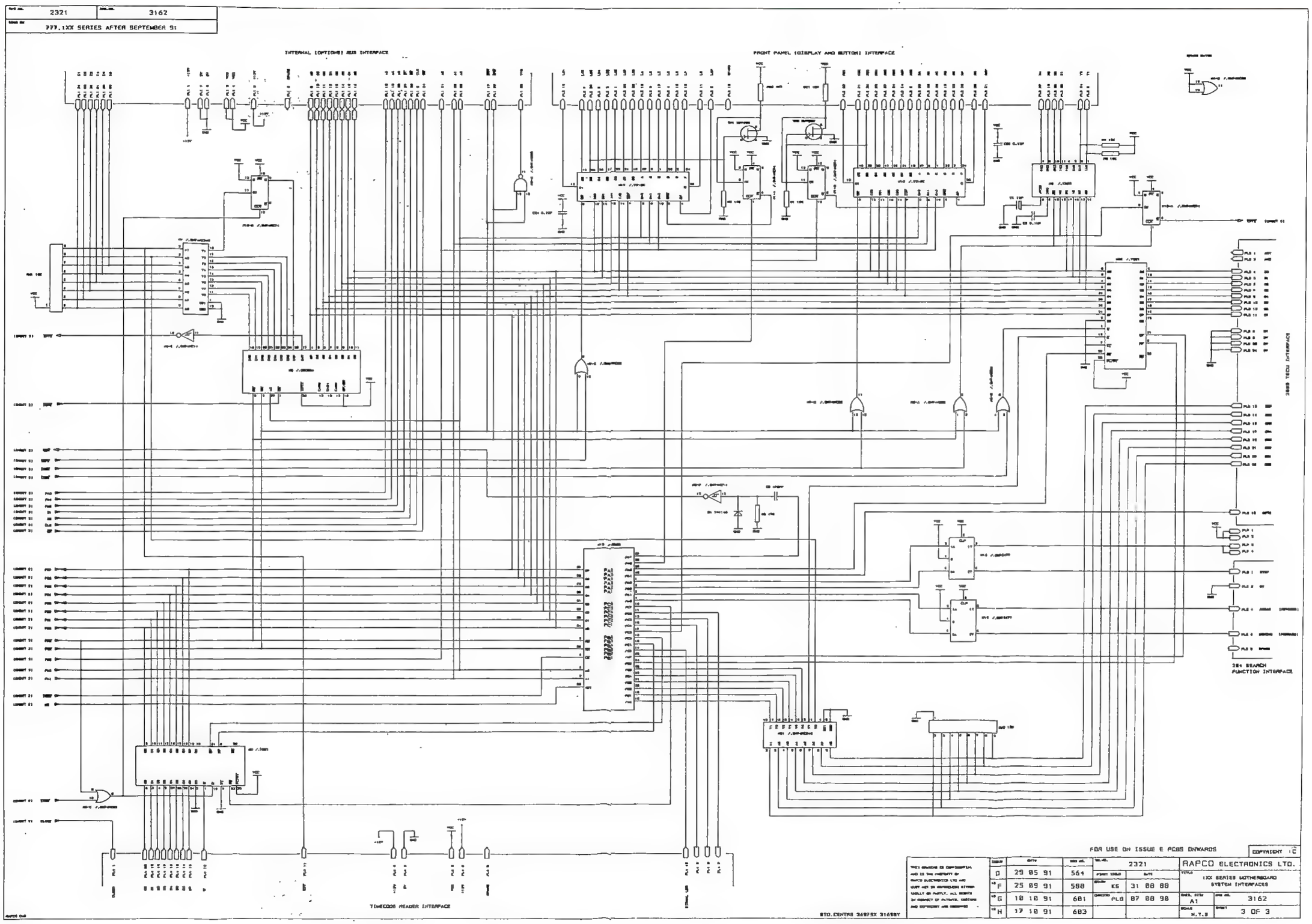
TITLE: 1XX SERIES MOTHERBOARD PROCESSOR AND MEMORY SECTION

ORG NO. 3162

SHEET 2 OF 3

STD.CENTRE 26975X 31689Y

2321	3162
777.1XX SERIES AFTER SEPTEMBER 91	



FOR USE ON ISSUE E PCBS ONWARDS

ISSUE	DATE	SHEET NO.
D	29 05 91	564
F	25 09 91	588
G	18 10 91	601
H	17 10 91	603

WO.NO.	2321
PCB NO.	31 08 88
DRAWN	KS
CHECKED	PLB 07 08 90
SHEET SIZE	A1
SCALE	N.T.S

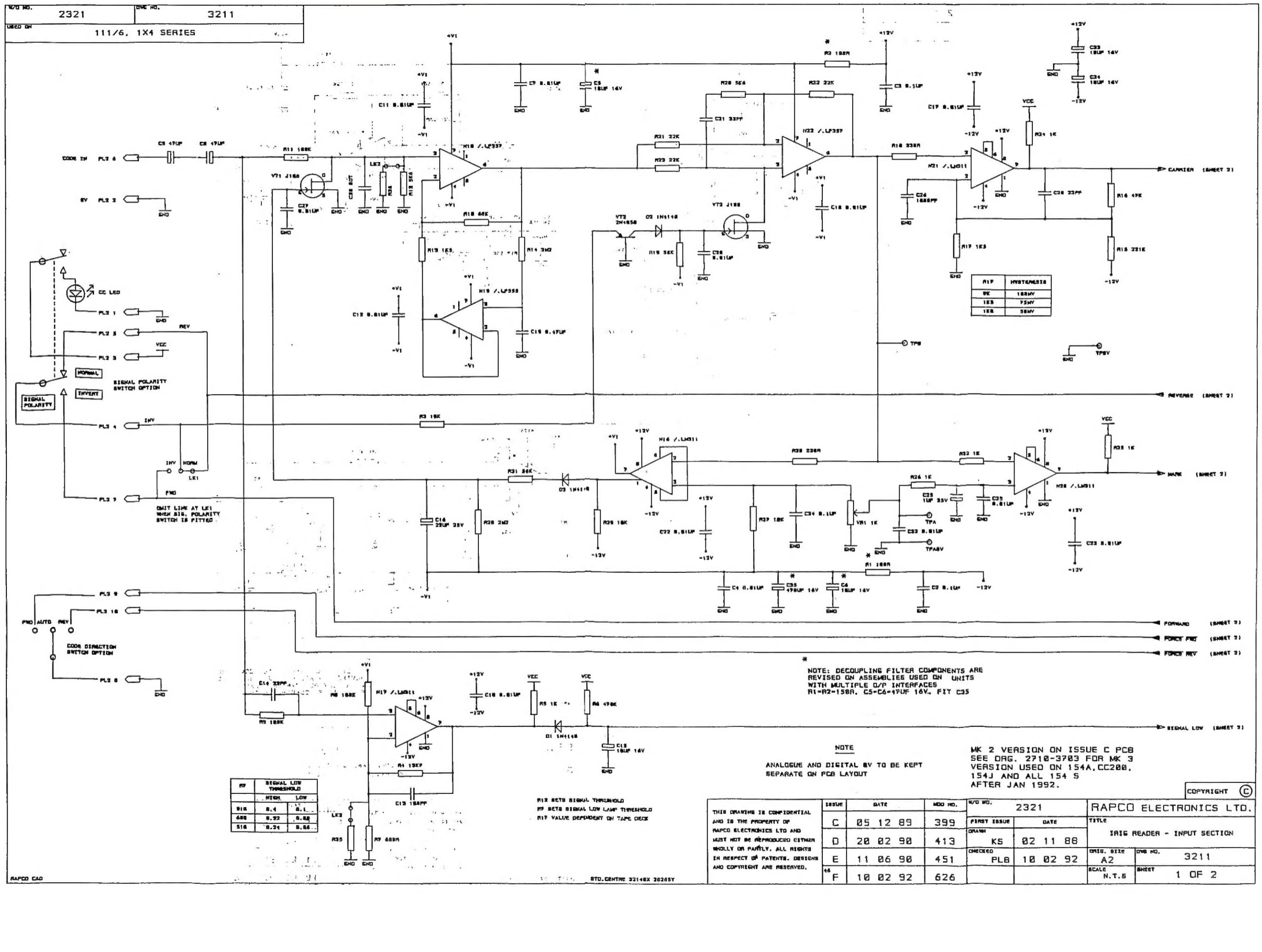
RAPCO ELECTRONICS LTD.

TITLE: 1XX SERIES MOTHERBOARD SYSTEM INTERFACES

DWG NO. 3162

SHEET 3 OF 3

W/O NO.	DWG NO.
2321	3211
USED ON	
111/6, 1X4 SERIES	



R17	HYSTERESIS
9K	188MV
1K5	75MV
1K8	58MV

R7	SIGNAL LOW THRESHOLD	
	HIGH	LOW
91R	0.4	0.1
680	0.92	0.68
51R	0.24	0.04

R12 SETS SIGNAL THRESHOLD
R7 SETS SIGNAL LOW LAMP THRESHOLD
R10 VALUE DEPENDENT ON TAPE DECK

NOTE: DECOUPLING FILTER COMPONENTS ARE REVISED ON ASSEMBLIES USED ON UNITS WITH MULTIPLE O/P INTERFACES
R1=R2=150R, C5=C6=47UF 16V, FIT C35

NOTE

ANALOGUE AND DIGITAL 0V TO BE KEPT SEPARATE ON PCB LAYOUT

MK 2 VERSION ON ISSUE C PCB
SEE DRG. 2710-3703 FOR MK 3
VERSION USED ON 154A, CC200, 154J AND ALL 154 S AFTER JAN 1992.

ISSUE	DATE	MOD NO.
C	05 12 89	399
D	20 02 90	413
E	11 06 90	451
F	10 02 92	626

W/O NO.	2321
FIRST ISSUE	DATE
DRAWN KS	02 11 88
CHECKED PL8	10 02 92

RAPCO ELECTRONICS LTD.

TITLE: IRIG READER - INPUT SECTION

ORIG. SIZE A2 | DWG NO. 3211

SCALE N.T.S | SHEET 1 OF 2

RAPCO CAD

STD.CENTRE 32148X 26265Y

R/D NO.	2321	DWG NO.	3211
USED ON	111/6, 1X4 SERIES		

ANALOGUE AND DIGITAL 0V TO BE KEPT
SEPERATE ON PCB LAYOUT

INTERFACE TO PROCESSOR

MK 2 VERSION ON ISSUE C PCB
SEE DRG. 2710-3703 FOR MK 3
VERSION USED ON 154A,CC200
154J AND ALL 154 S
AFTER JAN 1992.

ISSUE	DATE	MOD NO.
B	04 09 89	384
C	05 12 89	399
D	07 12 89	399
F	10 02 92	626

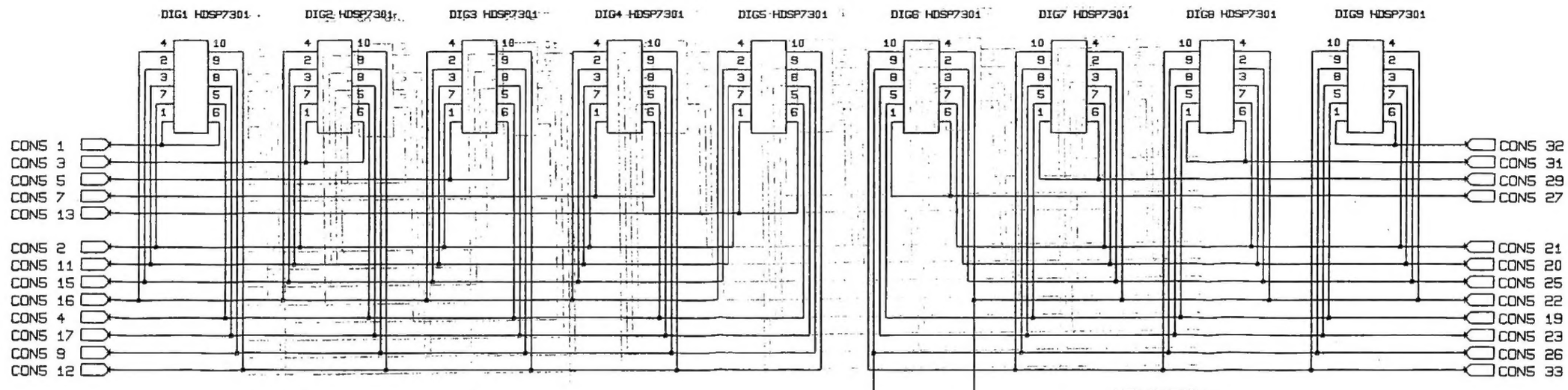
R/D NO.	2321	RAPCO ELECTRONICS LTD.
FIRST ISSUE	DATE	TITLE: IRIG READER - DECODER SECTION
DRAWN KS	02 11 88	
CHECKED PLB	10 02 92	DRG. SIZE A2 / DWG NO. 3211
		SCALE N.T.S / SHEET 2 OF 2

RAPCO CAD

W/O NO.	DRG NO.
2234	3008

USED ON: 143/144, 343/344

143/343 (XR3)	NOT FITTED	H X10	H	M X10	M	S X10	S	NOT FITTED	NOT FITTED
144/344 (IRIG)	D X100	D X10	D	H X10	H	M X10	M	S X10	S



LED FUNCTIONS

LED NO.	343/344 FUNC./COLOUR	143/144 FUNC./COLOUR
LED1	ARM (RED)	ARM (RED)
LED2		< (YELLOW)
LED3		= (YELLOW)
LED4		> (YELLOW)
LED5	CODE ON. (GREEN)	SIG LOW (RED)
LED6	BATT (GREEN)	SEARCH (GREEN)

ISSUE	DATE	MOD NO.
B	27 02 89	355

W/O NO.	2234	
FIRST ISSUE		DATE
DRAWN	PJH	5-6-87
CHECKED	PLB	01 07 90
ISSUED	TMB	01 07 90

RAPCO ELECTRONICS LTD.

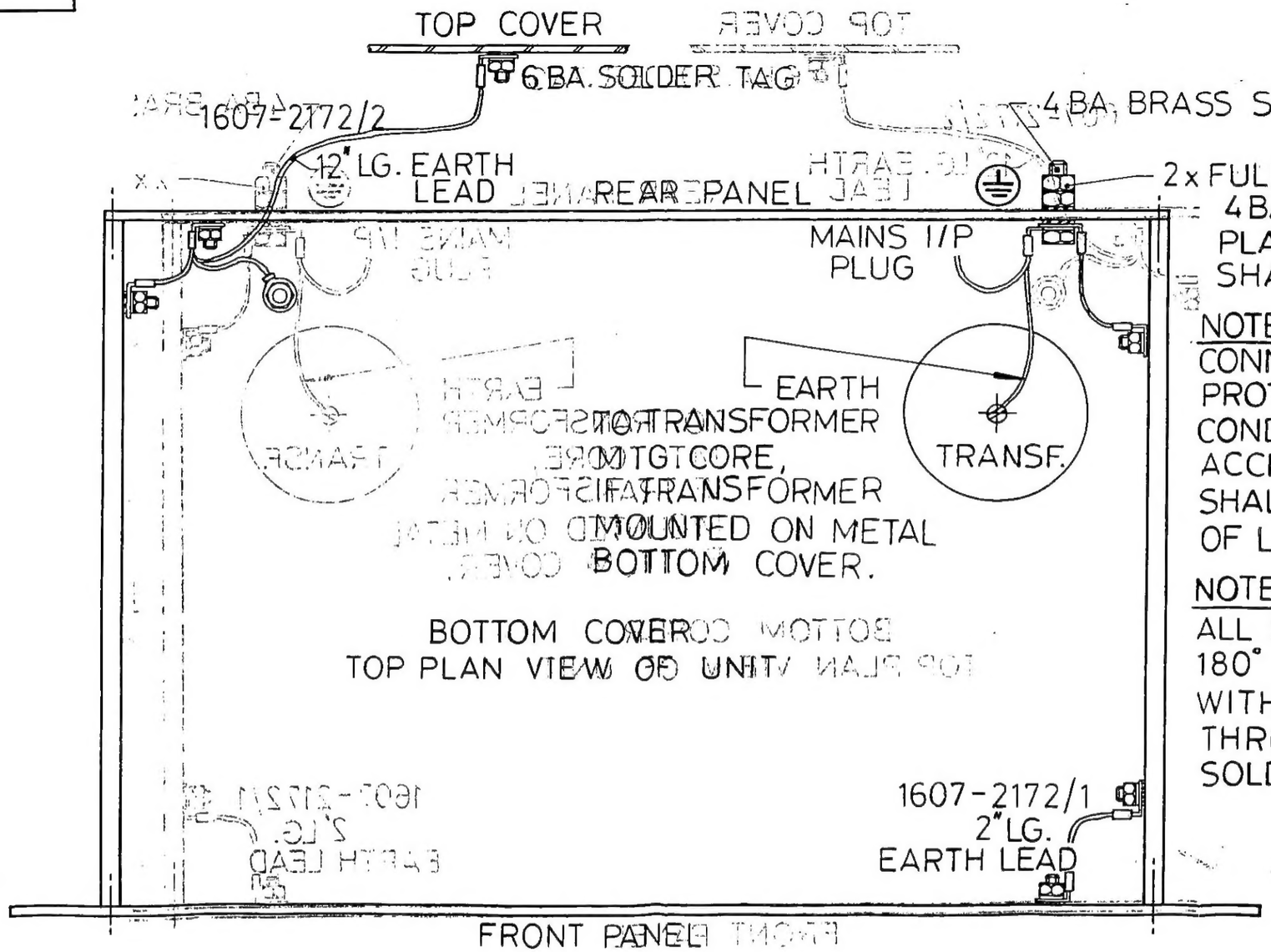
TITLE: 14X/34X DISPLAY BOARD

ORIG. SIZE: A3 | DWG NO.: 3008 | SCALE: - | SHEET: 1 OF 1

RAPCO CAD

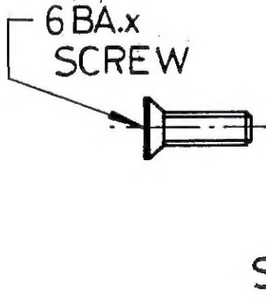
CENTRE 2871.0X 2584.5Y DSU

PART Nº 1607-2173



NOTE -
CONNECTIONS BETWEEN PROTECTIVE EARTHING CONDUCTOR AND ACCESSIBLE METAL PARTS SHALL HAVE A RESISTANCE OF LESS THAN 0·1 OHMS.

NOTE -
ALL SOLDER JOINTS TO BE 180° WRAP-AROUND JOINTS WITH WIRE PASSING THROUGH HOLE IN SOLDER TAG.



NOTE - BEFORE ASSEMBLY ENSURE THAT ALL EARTHING POINTS HAVE BEEN SPOTFACED TO REMOVE ANODISING.

CHECKED	DATE
RWB	8·11·83

A3		
RAPCO ELECTRONICS, LTD		
EARTH LINKAGE SYSTEM (ALL UNITS)		
D. BAKER	SCALE N.T.S	8.11.83
PART Nº 1607-2173		ISSUE F

ISSUE F MOD Nº 639 24.2.92